

# Four new *Dolichopoda* species from Greece, one *Troglophilus* new to Greece and new locality records (Orthoptera, Rhaphidophoridae)

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## Abstract

We describe four new species of the genus *Dolichopoda* from various areas of Greece, namely *D. athosensis* **sp. nov.**, *D. dirussoi* **sp. nov.**, *D. karoutsosi* **sp. nov.** and *D. kotsabasi* **sp. nov.** New locality records for Greece for the genera *Dolichopoda* and *Troglophilus* are given, in addition to the presence of *Troglophilus brevicauda* as a new country record. We discuss the relationship with the already known species of the area.

## Key Words

Cave crickets, distribution, faunistics, new records, new species, taxonomy

## Introduction

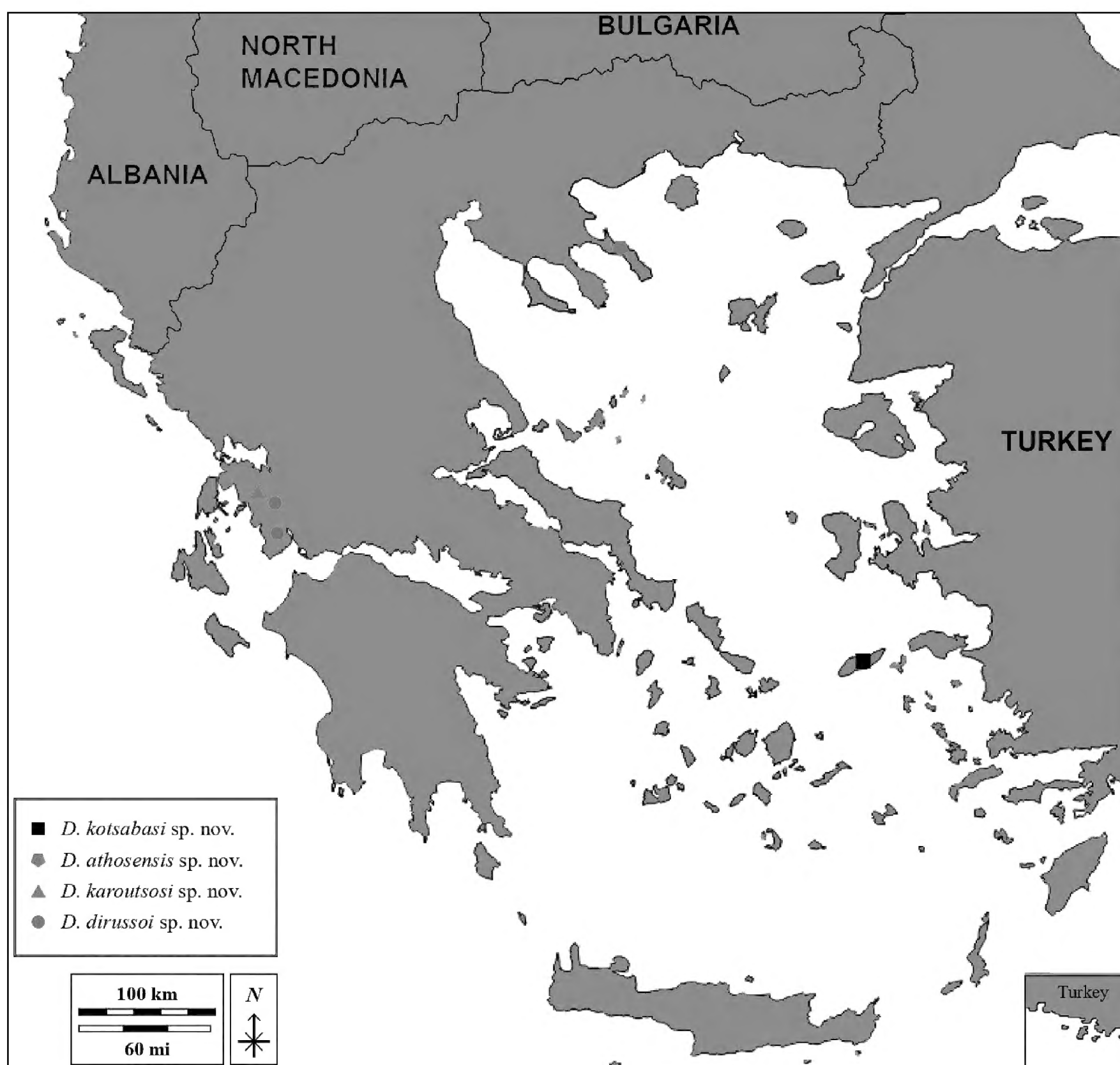
The Orthopteran family Rhaphidophoridae Walker, 1871 has a world-wide distribution of mostly cave-adapted genera (Allegrucci et al. 2009). In the Mediterranean, the family is represented by two genera, *Dolichopoda* Bolivar, 1880 and *Troglophilus* Krauss, 1879. The two genera are distributed largely in the north Mediterranean, having their distribution centres at Greece and Turkey (Allegrucci et al. 2009).

Alexiou et al. (2013) and Di Russo et al. (2014) catalogued 28 *Dolichopoda* species in Greece. Willemse et al. (2018) present a checklist of 29 species. Eight more species have been subsequently added to the Greek fauna (Di Russo et al. 2017, 2018; Allegrucci et al. 2021), one species endemic to the western mainland, three endemic to Aegean islands and four species endemic to Peloponnisos, thus raising the number of species to 36. With the four new species presented in this paper (Fig. 1), the total number reaches 40, with all endemic to Greece, except *D. remyi* Chopard, 1934.

Five species of *Troglophilus* were known from Greece until recently (Alexiou et al. 2013). Subsequently Di Russo et al. (2014) described *T. zoiai* Di Russo et al. 2014 from Central Greece and Davranoglou et al. (2021) added the Balkan *T. zorae* Karaman & Pavićević, 2011 to the Greek fauna. With the present contribution, the known number of *Troglophilus* rises to eight.

## Materials and methods

All the studied specimens were collected by hand from the walls of the caves during several field trips conducted between 2014 and 2022. Specimens were preserved in 70% ethanol and deposited in the collection of the Korinthian Museum of Natural History (KMNH). Permissions for collection of samples were obtained from the Ephorate of Palaeoanthropology and Speleology of the Ministry of Culture, Education, and Religious Affairs, Athens. Figures were drawn from photographs taken during the



**Figure 1.** Geographic distribution of *D. athosensis* sp. nov., *D. dirussoi* sp. nov., *D. karoutsosi* sp. nov. and *D. kotsabasi* sp. nov.

dissection process. For the morphological analysis, the following external body characters were utilized: lobes of the tenth tergum of males, median and basal processes of the epiphallus, the shape of the female subgenital plate and ovipositor. The epiphallus of adult males is extracted and preserved in microvial with glycerol. Measurements of the morphological parameters were taken using a digital caliper.

## Results and discussion

### Descriptions

#### *Dolichopoda athosensis* Alexiou, sp. nov.

<https://zoobank.org/F7D47D2D-185D-4093-A9D7-93B6A62CACBF>

Figs 1, 2

**Type material.** *Holotype*: GREECE • ♂; Macedonia, Nomos Chalkidikis, Agion Oros peninsula, Mt. Athos, Zographou monastery, cave Skiti; 40°18.488'N, 24°9.836'E;

15 Jul. 2017; K. Bakolitsas leg. (KMNH). **Paratypes**: GREECE • 5 nymphs, same data as for holotype.

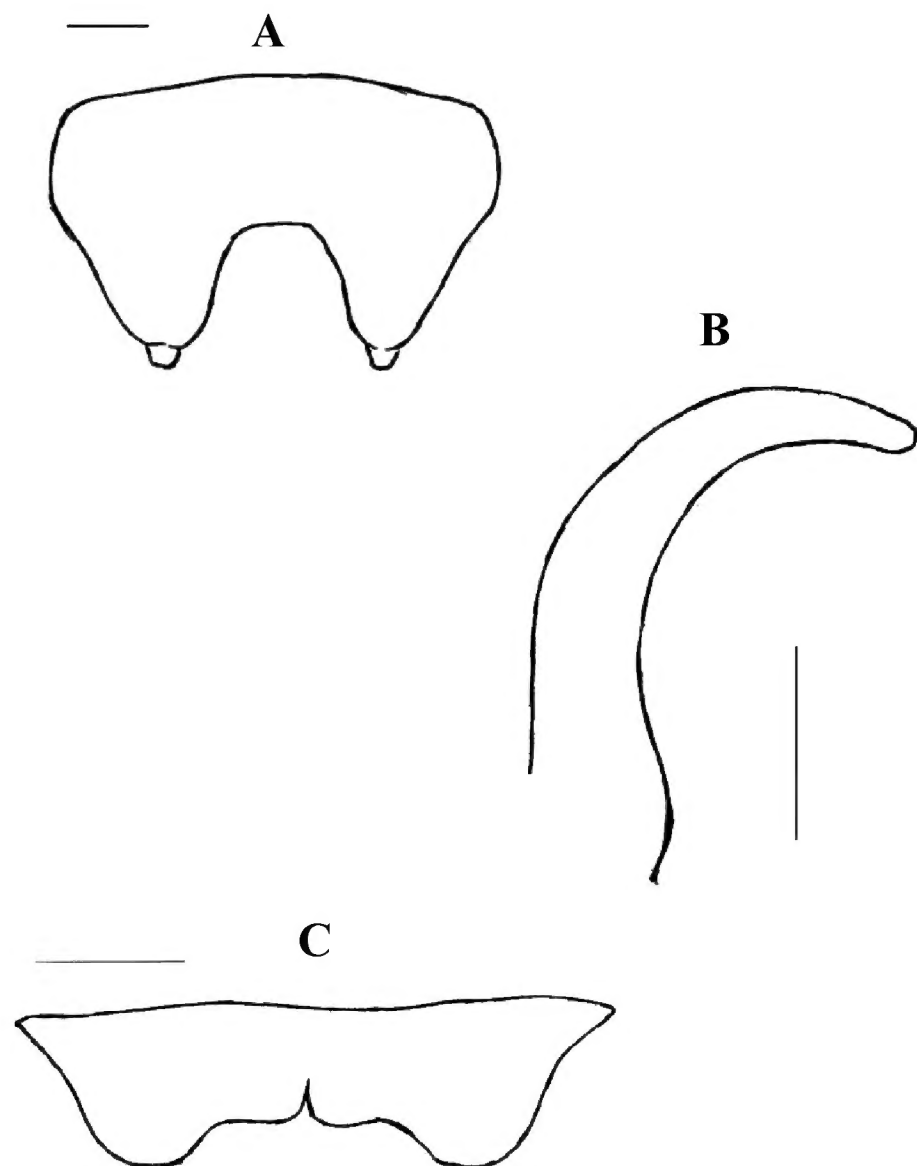
**Diagnosis.** The new species is related to *D. thasosensis* Chopard, 1964, endemic to the island of Thasos (Chopard 1964). It differs in the less pronounced lateral lobes of the X tergite, the dramatically curved median process of the epiphallus and the subgenital plate, which has broader incision with larger styli.

**Description.** Body pale testaceous, posterior margin of the terga dark. Legs elongated, hind femora unarmed. Fore tibiae with 4 spines on both sides of the ventral side, mid tibiae with 5 spines on both sides of the ventral side and hind tibiae with 18 spines on both sides of the dorsal side.

X tergum (last abdominal tergite) (Fig. 2C) square, with a shallow section in the middle and with two lateral lobes. Lobes not very pronounced, with rounded apex.

Subgenital plate (Fig. 2A) divided by a broad median incision, with triangular lateral lobes; styli short.

Epiphallus sclerotized (Fig. 2B). Median process of epiphallus with a broad base, strongly curved in lateral view, evenly leading to a rounded tip.



**Figure 2.** *Dolichopoda athosensis* sp. nov. male: **A.** Subgenital plate, ventral view; **B.** Epiphallus, lateral view; **C.** X tergum, dorsal view. Scale bars: 1 mm.

Measurements (length in mm): body 17, pronotum 4, fore femora 16, middle femora 17, hind femora 17.

**Female.** Unknown.

**Etymology.** The new species is named after Athos, a mountain dominating the Agion Oros peninsula.

**Distribution.** Known only from the type locality. Cave Skiti is located a few meters away from the Monastery of Zographou. The cave is about 10 m long, with the entrance facing south-east. The entrance is small (around  $0.5 \times 1.0$  m), and well hidden by lush vegetation.

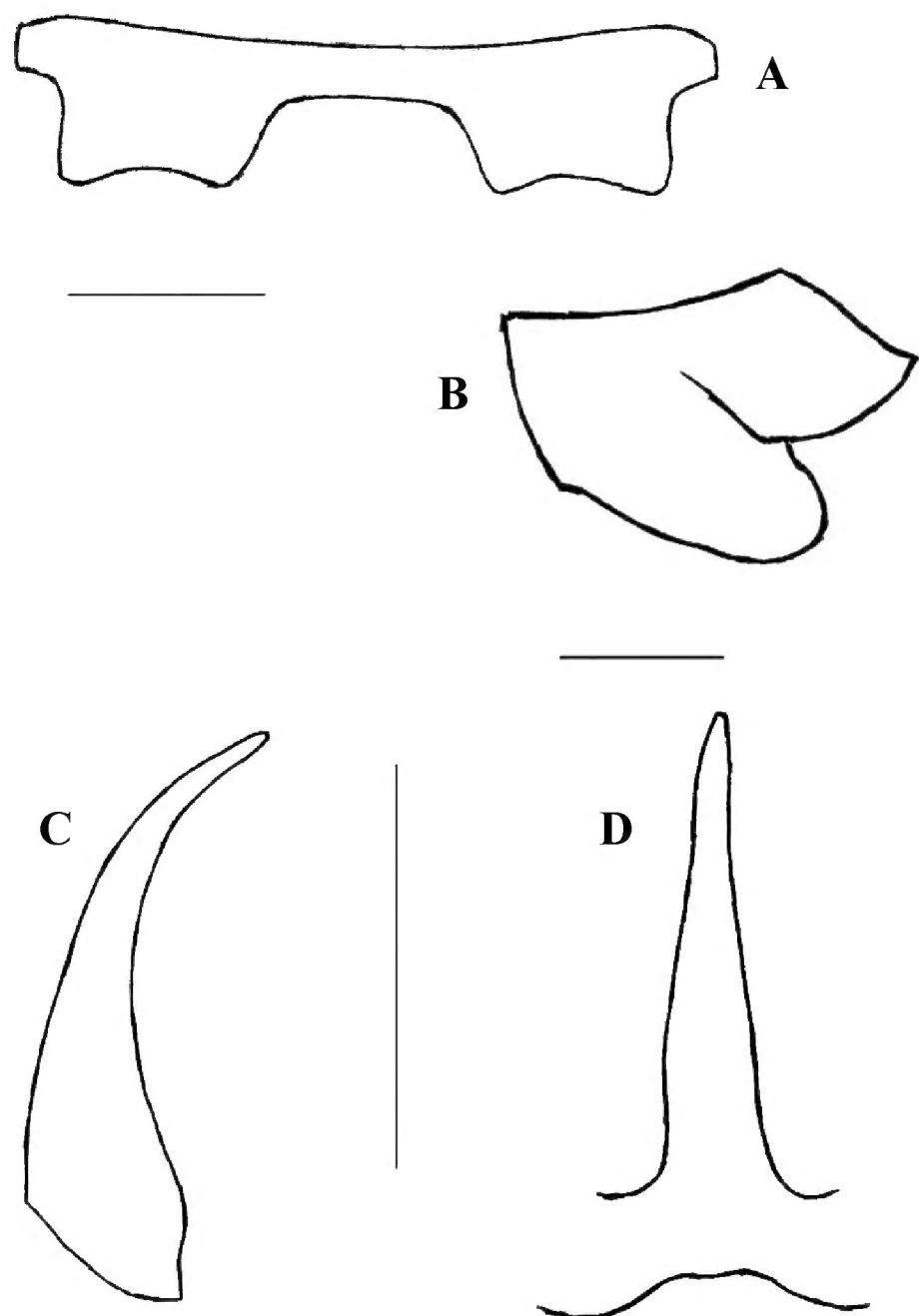
***Dolichopoda dirussoi* Alexiou, sp. nov.**

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Figs 1, 3, 4, 5

**Type material.** *Holotype*: GREECE • ♂; Sterea Ellas, Nomos Etolias-Akarnanias, Skourtou, Geralexis cave; 102 m a.s.l.;  $38^{\circ}38.150'N$ ,  $21^{\circ}12.617'E$ ; 25 Nov. 2017; K. Bakolitsas leg. (KMNH). *Paratypes*: GREECE • 1 ♂, 3 ♀; same data as for holotype. *Other material*: GREECE • 2 ♂, 6 ♀; Sterea Ellas, Nomos Etolias-Akarnanias, Gouria Aitolikou, cave Gouria;  $38^{\circ}27.383'N$ ,  $21^{\circ}16.478'E$ ; 7 Jan. 2018; K. Bakolitsas leg. (KMNH).

**Diagnosis.** The new taxon shows affinities with the other *Dolichopoda* species of the west Sterea Ellas, *D. giachinoi* Rampini & Di Russo, 2008 and *D. bakolitsasi* Rampini & Di Russo, 2017 as well as the species of the south Ionian Islands *D. gasparoi* Rampini &



**Figure 3.** *Dolichopoda dirussoi* sp. nov.: **A.** X tergum, male, dorsal view; **B.** Subgenital plate, female, lateral view; **C.** Epiphallus, lateral view; **D.** Epiphallus, dorsal view. Scale bars: 1 mm.

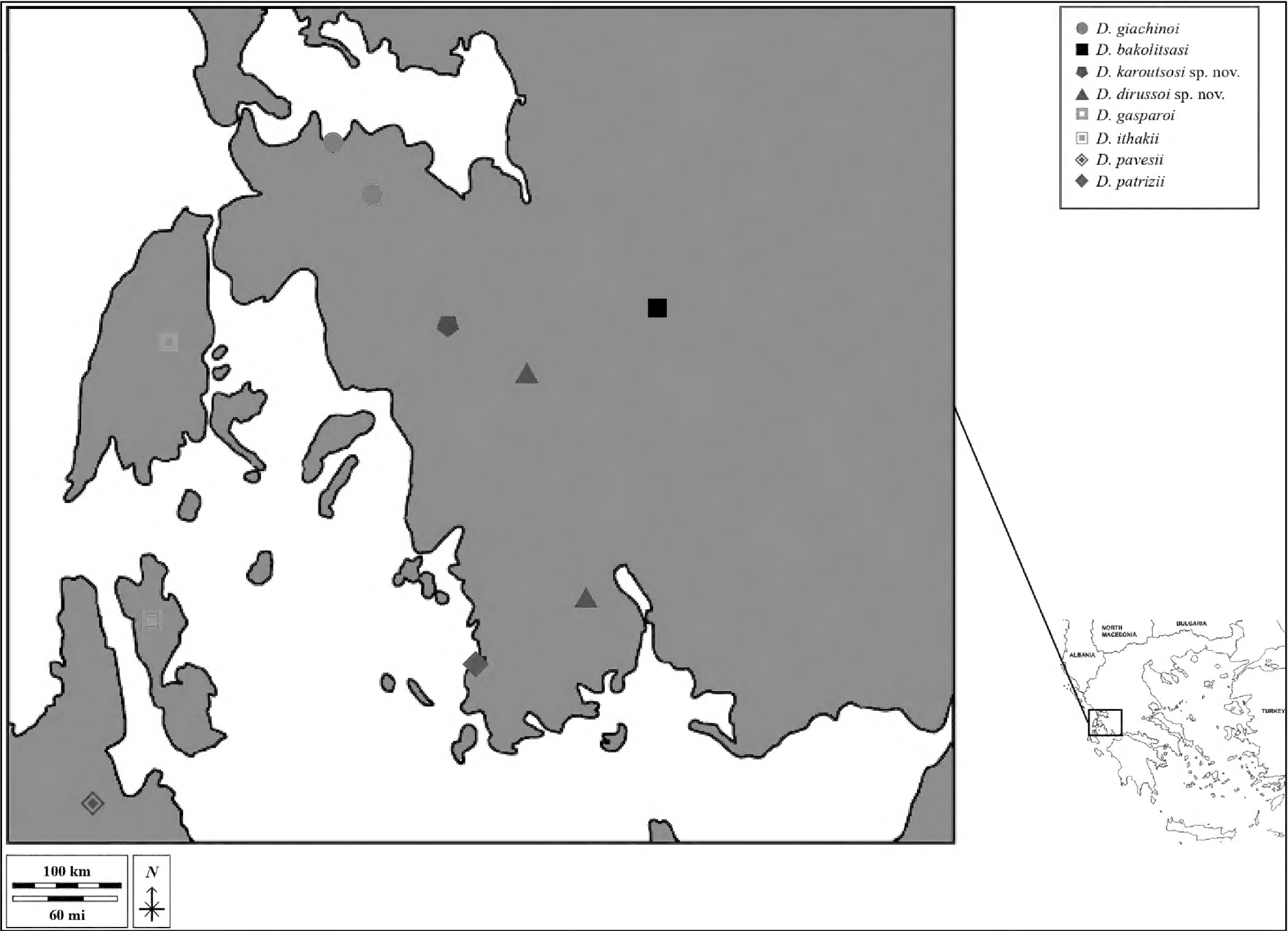
Di Russo, 2008, *D. ithakii* Rampini & Di Russo, 2008, *D. pavesii* Galvagni, 2002 and *D. patrizii* Chopard, 1964. (Fig. 4). The combination of the morphological characters of *D. dirussoi* sp. nov. is unique among the neighbouring species, with the most outstanding difference being the lack of a ridge or tubercles on the X tergite of males. Despite the obvious differences of the new species from *D. bakolitsasi*, especially in the shape of the lateral lobes of the X tergum, the two species stand out from the others by the strongly curved median process of the epiphallus.

**Description.** Body pale brownish-yellow, legs elongated, hind femora unarmed. Fore tibiae with 3 spines on both sides of the ventral side, mid tibiae with 4 spines on both sides of the ventral side and hind tibiae with 20 spines on both sides of the dorsal side.

X tergum (last abdominal tergite) (Fig. 3A) with two lateral lobes, lobes shallowly bilobed at apex. Lateral lobes separated by a broad concavity, broader than the lobes, inner side of the concavity slightly more thickened.

Subgenital plate convex, with a wide median incision that runs for half of the total length; lateral lobes rather rounded, styli short.





**Figure 4.** Geographic distribution of *Dolichopoda* species at W Sterea Ellas and S Ionian Islands.



**Figure 5.** *Dolichopoda dirussoi* sp. nov., in copula, cave Geralexis (photo Bakolitsas).

Epiphallus sclerotized, with the median process thickened to about 2/3 of its length, strongly curved and acute (Fig. 3C, D).

Measurements (length in mm): body 16, pronotum 3.4, fore femora 17, middle femora 18, hind femora 23.

**Female:** Characters similar to male. Subgenital plate large, triangular with a rounded apex. Sternite VII with a very large protuberance covering the anterior half of the sternite (Fig. 3B), in the shape of flattened triangle with thickened margins and rounded apex. Ovipositor 14 mm in length, almost straight, the inferior valves with 19 apical denticles.

**Etymology.** The new species is named after our dear friend and co-author Claudio Di Russo, who introduced S.A. into the study of Greek cave crickets thirteen years ago.

**Distribution.** Known only from the two caves of Etolia-Akarnania. Cave Geralexis is approximately 30 m long, with its entrance facing east. It appears to have been twice as long but has collapsed. The entrance is quite large (4.0 × 8.0 m), although well hidden by lush vegetation. The cave is composed of one main room and a second smaller room to the left, where the cave crickets were found.

***Dolichopoda karoutsosi* Alexiou, sp. nov.**

<https://zoobank.org/B8FB5B44-87C3-492F-82BB-3587D83A304E>

Figs 1, 4, 6

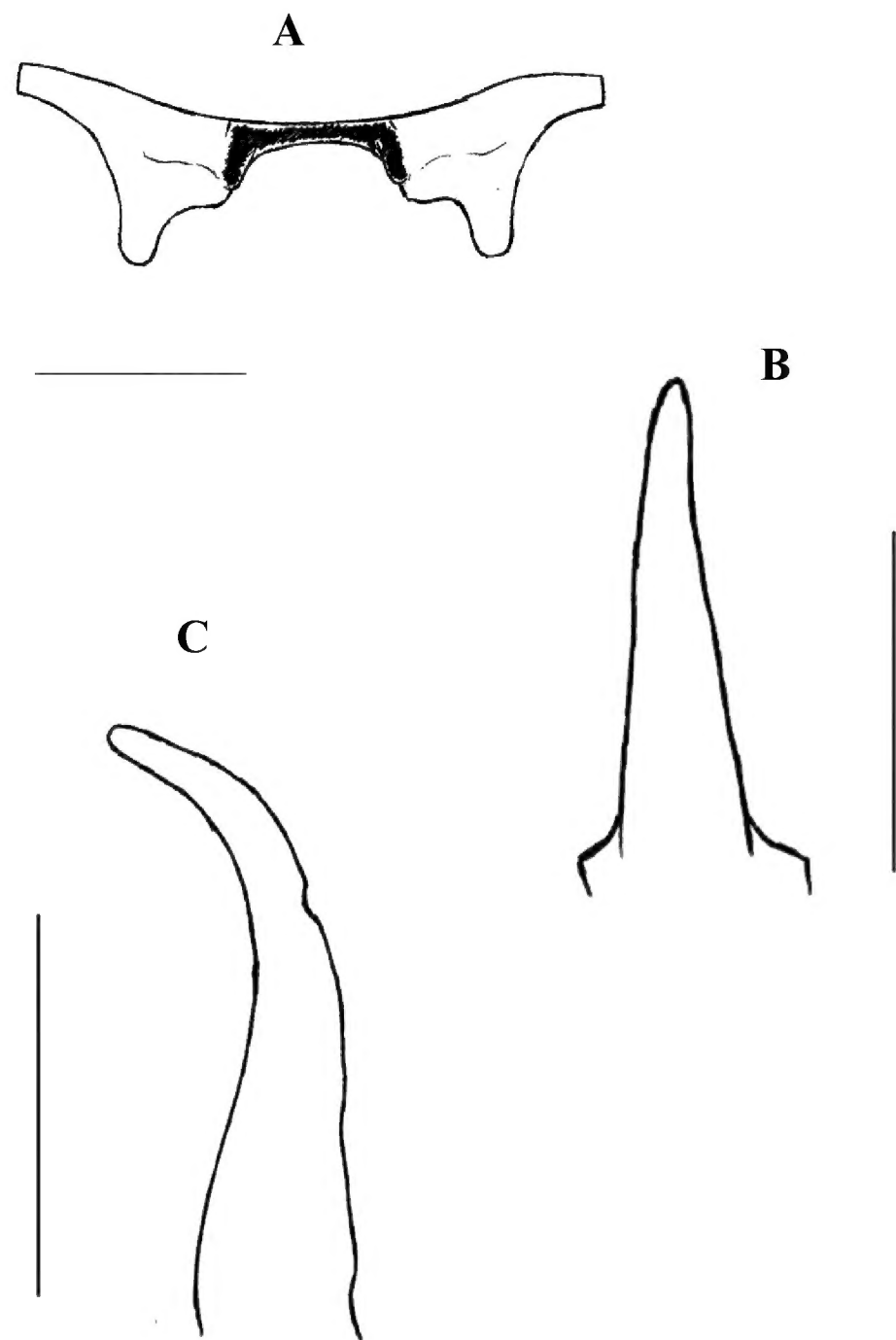
**Type material. Holotype:** GREECE • ♂; Sterea Ellas, Nomos Etolias-Akarnanias, Aetos, Agios Nikolaos, cave Siko; 38°43.435'N, 21°6.977'E; 344 m a.s.l.; 7 Aug. 2017; K. Bakolitsas leg. (KMNH). **Paratypes:** GREECE • 2 ♂, 1 nymph, same data as for holotype.

**Diagnosis.** The new taxon presents one morphological character unique for the genus: the presence of a notch at the median process of the epiphallus (present at both dissected males). The shape of the lateral lobes of X tergum of the males shows resemblance to *D. bakolitsasi*, a species known from a cave a few km away. The elevated ridge at the posterior margin of the concavity of the X tergite and the rather slender median process of epiphallus connects the new species with the species of the south Ionian region, e.g. *D. garparoi*, *D. ithakii*, *D. giachinoi* and *D. patrizii* (Fig. 4).

**Description.** Body pale brownish-yellow, legs elongated, hind femora unarmed. Fore tibiae with 4 spines on both sides of the ventral side, mid tibiae with 5 spines on both sides of the ventral side and hind tibiae with 19 spines on both sides of the dorsal side.

X tergum (last abdominal tergite) (Fig. 6A) with two lateral lobes, shallowly bilobed at apex. Bilobed apex very unequal, the external side elongated, cylindrical, pointing dorso-posteriorly. The two lobes are separated by a large concavity showing an elevated ridge on the posterior margin.

Subgenital plate convex, with a wide median incision that runs for 1/3 of the total length; lateral lobes rounded, styli short, inserted at the side of the lateral lobes.



**Figure 6.** *Dolichopoda karoutsosi* sp. nov., male: **A.** X tergum, dorsal view; **B.** Epiphallus, dorsal view; **C.** Epiphallus, lateral view. Scale bars: 1 mm.

Epiphallus sclerotized, median process rather slender and acute, the last 1/4 curved inwards, an obvious notch is present at the beginning of the curve (Fig. 6B, C).

Measurements (length in mm): pronotum 3.6, fore femora 17, middle femora 18, hind femora 26, body 16.

**Female.** Unknown.

**Etymology.** The new species is named after our friend, geologist Panos Karoutsos, a dear companion of the second author who visited the type locality and many other caves together.

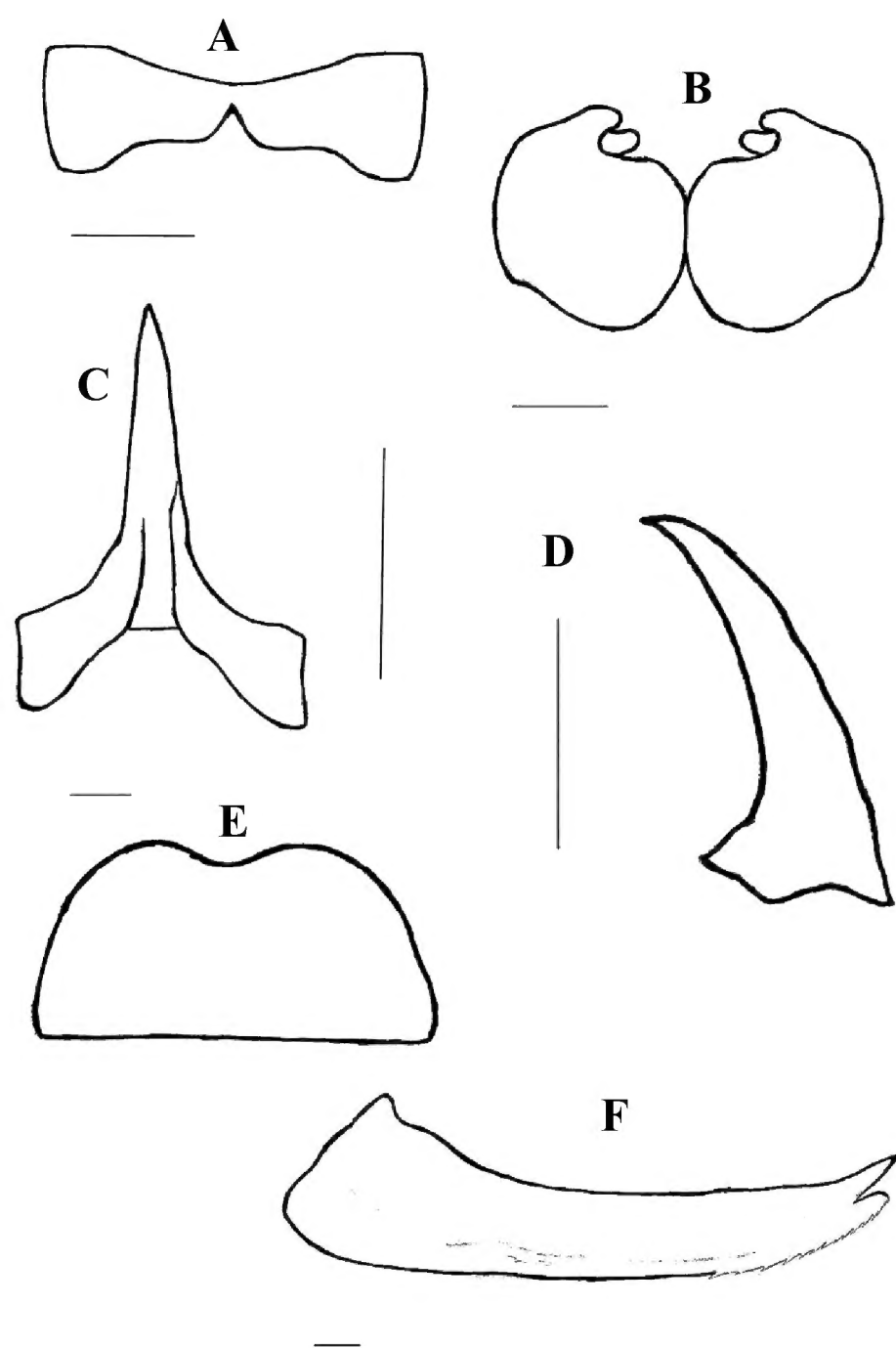
**Distribution.** Known only from the type locality. Siko is a pit fall 7 m deep, with a spacious 8 × 7 m room at its base, without decoration and with high humidity. The entrance is about 0.5 × 1 m, facing east and on the floor there are many bones belonging to animals that have fallen from the cave entrance.

***Dolichopoda kotsabasi* Alexiou, sp. nov.**

<https://zoobank.org/75A95E04-CD6A-4A8E-ACE2-9D80D7A845DA>

Figs 1, 7

**Type material. Holotype:** GREECE • ♂; Nomos Samou, Ikaria Isl., near Akamatra, cave Alama; 37°36.124'N, 26°10.816'E; 370 m. asl.; 24 Sep. 2022; S. Alexiou & K.



**Figure 7.** *Dolichopoda kotsabasi* sp. nov.: **A.** X tergum, male, dorsal view; **B.** Subgenital plate, male, ventral view; **C.** Epiphallus, dorsal view; **D.** Epiphallus, lateral view; **E.** Subgenital plate, female, ventral view; **F.** Ovipositor, lateral view. Scale bars: 1 mm.

Kotsabas leg. (KMNH). **Paratypes:** GREECE • 1 ♂, 1 ♀, same data as for holotype. **Other material:** GREECE • 1 ♂, 1 ♀; Nomos Samou, Ikaria Isl., Petropouli, cave Raos Choutra; 24 Sep. 2022; S. Alexiou & K. Kotsabas leg. (KMNH).

**Diagnosis.** The new species shows a strong resemblance to the already known species of the central Aegean area. It is mostly similar to the two cave crickets endemic on the nearby island of Samos, *D. giulianae* Rampini & Di Russo, 2012 and *D. kalithea* Di Russo & Rampini, 2012, as well as to the Anatolian *D. sutini* Rampini & Taylan, 2012, the females especially being very similar (Rampini et al. 2012). The males of both species of Samos have a more robust and arched median process of the epiphallus than *D. kotsabasi* sp. nov. Furthermore, the males of *D. kalithea* have trapezoidal, not globular, lobes at the subgenital plate and *D. giulianae* have squared lobes at the X tergum. *Dolichopoda sutini* also presents a differently shaped median process of the epiphallus as well as differently shaped lateral lobes of the subgenital plate of the males. The new species shows very similar median process of the epiphallus with *D. calidnae*, endemic to Kalymnos Island, *D. paraskevi*, endemic to Crete,

as well as to *D. naxia*, endemic to Naxos Island, being elongated, more slender and less arched. However, it shows significant differences in most other characters for both sexes.

**Description.** Body pale testaceous, posterior margin of the terga darker. Hind femora unarmed, hind tibiae with 24/25 spines on both sides.

Fore tibiae with 4 spines on both sides of ventral side, mid tibiae with 5 spines on both sides of ventral side and hind tibiae with 19 spines on both sides of dorsal side.

X tergum (last abdominal tergite) (Fig. 7A) slightly incised in the middle, with two lateral triangular lobes, lobes with rounded apex.

Subgenital plate (Fig. 7B) globular, divided by a median triangular incision, with short lateral lobes; styli short, inserted almost at the apex of the plate, where an incision occurs.

Epiphallus sclerotized, with an acute cylindrical median process. Median process slightly curved inwards, laterally robust at the base (Fig. 7C, D).

Measurements (length in mm): body 17, pronotum 4, fore femora 15, middle femora 16, hind femora 26.

**Female.** As in male. Subgenital plate rounded, slightly incised in the middle (7E). Ovipositor 9 mm, robust at the base, slightly arched upwards, lower valves with 15 denticles (7F).

**Etymology.** The new species is named after botanist Konstantinos Kotsabas, a researcher of the flora of Ikaria who was the first to observe the cave crickets on the island.

**Distribution.** Known only from two caves on Ikaria Island. A third population of presumably the same species was observed by Konstantinos Kotsabas at Chalavra Katafigi, inside a narrow cave opening underneath the chapel of Agios Nikolaos.

## New faunistic records

### *Troglophilus brevicauda* Chopard, 1934

Fig. 8

**Material examined.** GREECE • 6 ♂, 3 ♀; Thraki, Nomos Xanthi, road Xanthi-Stavroupoli, cave Lykodromio; 41°14.262'N, 24°45.838'E; 526 m a.s.l.; 17 Aug. 2020; G. Kofinas leg. (KMNH).

**Comment. New for Greece.** *Troglophilus brevicauda* is a species known from Serbia, Bosnia/Herzegovina, Montenegro, North Macedonia and Bulgaria (Karaman et al. 2011). In Bulgaria, the species is found in the Rhodopi Mountain range in the south. Rhodopi is shared by Greece and Bulgaria, with our location on the Greek side expanding the distribution of the species to cover all of the mountain range. According to Karaman et al. (2011), the population is an isolated local one. All the key morphological characteristics fit those of the species.

The record of an immature individual from Mt Falakro, E. Macedonia by Di Russo et al. (2014) could very well belong to the same species.





**Figure 8.** *Troglophilus brevicauda* Chopard, 1934. Greece, Thraki, Cave Lykodromio, 17 Aug. 2020 (photo Kofinas).

***Troglophilus zoiai* Di Russo, Rampini & Cobolli, 2014**

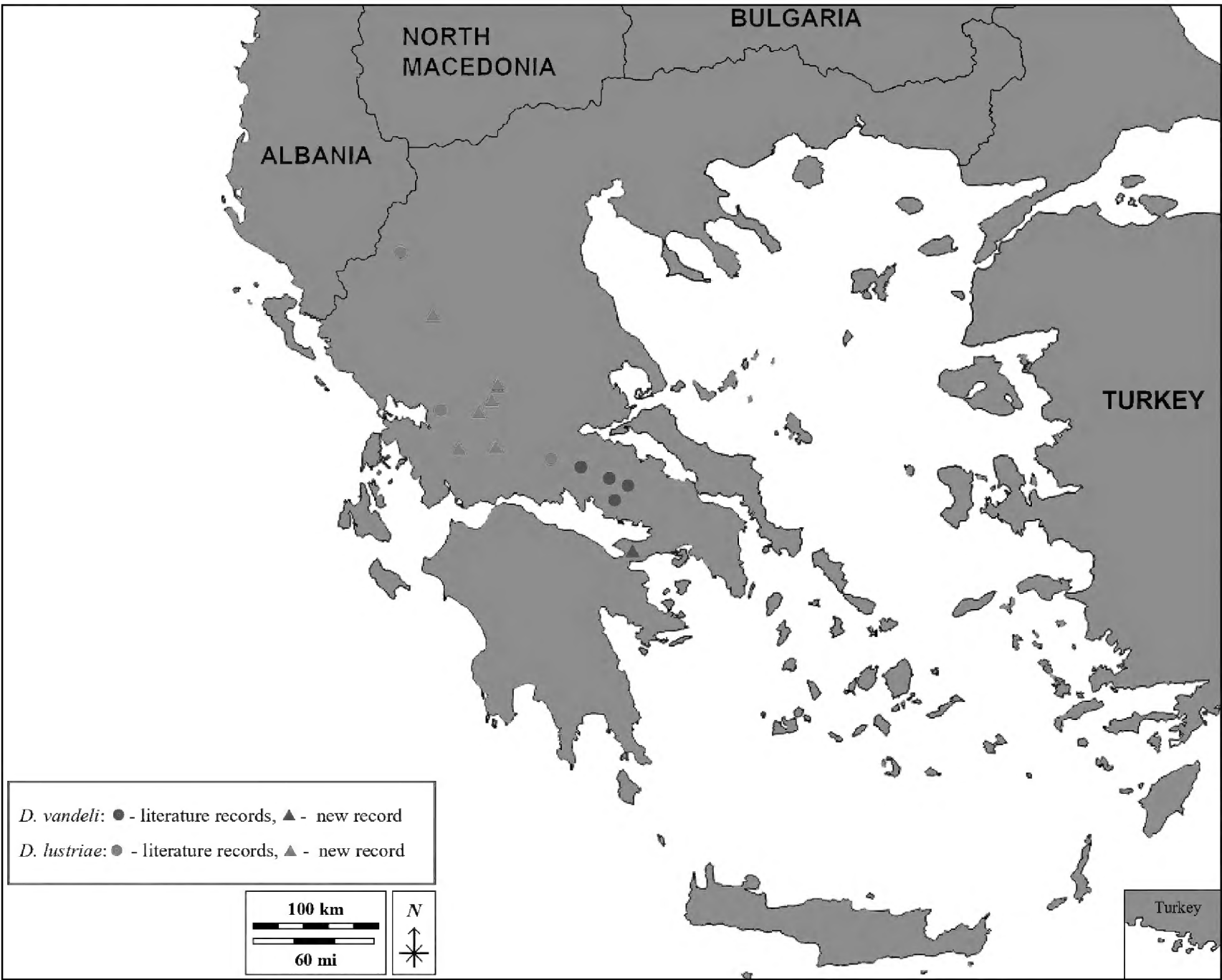
**Material examined.** GREECE - Sterea Ellas • 2 ♂, 1 ♀; Nomos Phthiotidos/Nomos Phokidos, Mt. Iti, cave Agio Pneuma; 1260 m. a.s.l.; 6 Sep. 2015; K. Bakolitsas leg. (KMNH) • Nomos Phokidas, Mt. Parnassos, cave Baroutospilia; 27 Dec. 2014; obs. & ph. Kofinas.

**Comment.** A species recently described from Mt. Parnassos, Central Greece, present also at Mt. Vardousia and Mt. Giona (Alexiou et al. 2014; Di Russo et al. 2014).

***Dolichopoda vandeli* Boundou-Saltet, 1970**

**Material examined.** GREECE • 1 ♂, 1 ♀, 2 nymphs; Sterea Ellas, Nomos Korinthias, Mt. Gerania; 38°00'40.0"N, 23°03'14.2"E; 23. May 2020; Kofinas leg. (KMNH).

**Comment.** *Dolichopoda vandeli* was described from Hermes cave, Nomos Biotias, Orchomenos, near the village of Dionysos, at the north of the plane of Kopais. Subsequently it has been collected from two more caves of Kopais plane, near Akontio and Katavothra Aliartos, in addition to Mt. Elikon, Agia Triada cave and the north foothills of Mt. Parnassos (Ano Polydroso, cave Kontilospilia) (Alexiou et al. 2014; Di Russo et al. 2014). Our record is a significant expansion of the species range to the south (Fig. 9).



**Figure 9.** Geographic distribution of *D. lustriae* Rampini & Di Russo, 2008 and *D. vandeli* Boundou-Saltet, 1970.

***Dolichopoda lustriae* Rampini & Di Russo, 2008**

Fig. 10

**Material examined.** GREECE – **Thessalia** • 2 ♂, 2 ♀; Nomos Karditsas, Mt. Agrapha, cave Gaki; 9 Dec. 2018; S. Alexiou leg. (KMNH) • 1 ♀; Nomos Karditsas, Mt. Agrapha, refuge; 8 Oct. 2018; L. Makrostergios leg. (KMNH) • 1 ♂, 3 ♀; Nomos Trikalon, Anthousa, Monastery of Galaktotrophousa; 1 Aug. 2020; c. 1150 m a.s.l.; G. Kofinas leg. (KMNH). - **Stereia Ellas** • 1 ♀; Nomos Evritanias, Neraida, cave Patriarchis; 13 Aug. 2021; K. Bakolitsas leg. (KMNH) • 2 ♂, 1 ♀; Nomos Evritanias, cave Mesokomis; 31 Aug. 2021; leg. K. Bakolitsas (KMNH) • 1 ♂, 2 ♀; Nomos Etolias-Akarnanias, Stoa Achelou, close to lake Kastrakiou; 38°49'09.3"N, 021°25'16.8"E; 854 m. a.s.l.; K. Bakolitsas leg. (KMNH).

**Comment.** *Dolichopoda lustriae* was originally described from Mt. Pselovuni of Etolia-Akarnania. Two more populations were added in the following years: Mt. Vardousia Fokidos (Alexiou et al. 2014) and Pades Ipiros (Davranoglou et al. 2018). The new populations added here demonstrate the wide distribution of the species along the high altitudes of the Pindos mountain range (Fig. 9), which may imply the more epigeal biological circle of *D. lustriae*, as discussed at Davranoglou et al. (2021).

***Dolichopoda giachinoi* Rampini & Di Russo, 2008**

**Material examined.** GREECE • 1 ♂, 2 ♀; Sterea Ellas, Nomos Etolias-Akarnanias, Vonitsa, cave Likonikos; 38°50.354'N, 20°55.665'E; 6 Jun. 2016; K. Bakolitsas leg.

**Comment.** The species has been described recently from Megalo Spilio cave, at the northern side of Mt. Serekas (part of Mt. Akarnanika) and from an altitude of 1000 m. a.s.l. (Rampini et al. 2008). The new locality extends the distribution of the species to the north, close to the Ionian Sea and away from the mountainous area of Akarnanika.

***Dolichopoda graeca* Chopard, 1964**

**Material examined.** GREECE • 2 ♂; Ipiros, Nomos Ioannina, Ioannina, Aslan Tzami ('Katakombes'); 17 Oct. 2021; S. Alexiou, S. Zacharias & O. Tzortzakaki leg. (KMNH).

**Comment.** Anna Petrochilou, the prominent Greek speleologist, was the first to observe and report (Petrochilou 1975–1976) cave crickets at her inspection of 'Katakombes' which are the caves situated underneath the mosque of Aslan Tzami. The mosque was built by the Ottoman pasha Aslan in 1618 in the castle of the town of Ioannina and is now operating as the Municipal Museum of Ioannina. After almost half a century, a name can finally be assigned to the population; they belong to *Dolichopoda graeca*, a species known only from the type locality, the cave of Perama, 4 km from the town of Ioannina (Chopard 1964; Di Russo et al. 2014).



**Figure 10.** *Dolichopoda lustriae* Rampini & Di Russo, 2008. Greece, Thessalia, Anthousa, Monastery of Galaktotrophousa, 1 Aug. 2020 (photo Kofinas).

***Dolichopoda gasparoi* Rampini & Di Russo, 2008**

**Material examined.** GREECE - **Ionian Islands** • 4 ♂; Nomos Lefkadas, Lefkada Isl., cave Alatos; 7 Aug. 2016; K. Bakolitsas leg. (KMNH) • 2 ♂; Nomos Lefkadas, Lefkada Isl., cave Pouliezou; 23 Aug. 2016; K. Bakolitsas leg. (KMNH) • 4 ♂; Nomos Lefkadas, Lefkada Isl., cave Tsotsonia; 25 Sept. 2016; K. Bakolitsas leg. (KMNH).

**Comment.** *Dolichopoda gasparoi* is endemic to Lefkada Isl. (Rampini et al. 2008). Our records indicate that the species is widespread on the island.

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